

Developing Zones, Regulations, and Penalties for Community-based Marine Managed Areas:

This supplement to the PIMPAC Management and Adaptation Planning Guide provides a step by step process that community-based practitioners can use to develop Zones, Regulations, and Penalties for their Managed Areas (MAs). More thorough zoning guides exist and should be referenced. This document is intended to be short and easy to use in the context of the Management and Adaptation Planning process for community-based managed areas. Ideally community-based practitioners would have the support of a mentor and/or marine biologist experienced with zoning when they apply these steps.

The current PIMPAC guide has recently be adapted to cover both Management Planning and Climate Change Adaptation Planning for terrestrial and marine managed areas. The previous version only addressed Management Planning for marine and coastal managed area. While several aspects of this supplement can be applied to the terrestrial context, the focus is on zoning and developing regulations for marine managed areas (MMAs). This supplement does includes consideration of vulnerability to the impacts of climate change and options for climate change adaptation in the zonation and regulatory process.

Background:

Developing effective zones, regulations, and penalties is essential to the success of managed areas. Some managed areas will be relatively simple and have only one zone, while others may be much more complex having several zones and regulations. Developing zones and regulations can be very contentious or may be relatively straightforward. Since this process is focused on community-based managed areas, the local community and its Planning Team will be the primary group to determine the zones and regulations. However Planning Team should make sure they have good scientific advice to make sure the zones and regulations have the greatest probability possible of supporting the community's objectives.

Before we provide suggested steps for developing zones and regulations it is important to review some basic definitions.

Managed Area:

Traditionally communities across the Pacific managed the natural resources within their entire traditional land and water. Today several communities are pursuing the same approach by considering their entire jurisdiction or area that they control or influence as their managed area. Within this managed area, they may identify certain areas that are zoned to allow or disallow certain uses. These zones often have specific designations that indicate their primary status and/or objective. Examples include: "a fisheries replenishment zone", a "no take zone" or a "tourism zone".

While some communities have opted to create specific Marine Managed Areas that cover only a portion of their traditional waters, we suggest that communities develop a zoning and regulatory plan for the entire area of land and sea that they control or influence. In the long-run this will

provide for more comprehensive and more effective management. As a result, for the purposes of this guide, we consider the managed area to be the entire area that a community controls or influences and the marine managed area to be the marine waters and coast within that area. Zones are subsets of this overall managed area that allow or disallow specific uses.

Zoning

Zoning is the process of determining what activities will be allowed and not allowed in which parts of a Managed Area. Some key things to keep in mind about zoning include:

- Zoning is a critical management tool for successful managed areas. It sets aside key areas for specific activities such as fishing and tourism while setting aside other areas for protection of key biological features, fisheries replenishment, or cultural features.
- Zoning is a tool that is used to help MMA managers achieve their objectives. As a result, development of zones should flow directly from the objectives which are developed for the MMA. Objectives can be thought of as the Results or the Outcomes that a MMA is designed to achieve.
- Zones must be chosen on a sound biological and socio-economic basis. If a community want to ensure that grouper population increase, they must then chose their zones and regulations to ensure that grouper reproduction and growth is protected. If they want to increase populations to support community fishing, they must design their zoning the regulatory scheme to balance the reproduction and growth of grouper populations with sustainable levels of fishing. It is important that a marine or fisheries biologists advise the community on these decisions that involve precise biological decisions.
- Given the threat of climate change, the zoning process should consider possible long-term impacts, the vulnerability of key natural and socio-economic resources to climate change impacts, and work to identify and manage areas that may be particularly resilient or resistant to climate change impacts.
- Zoning can often be a balancing act between the needs of the biological system to be productive and healthy and thus produce resources that are important to community members and the needs of communities that may depend on resource use for their survival. Biological systems can only produce a finite level of resource, so zoning and regulation must very carefully consider the productivity of the natural system when making choices about levels of and areas for human use.
- If designed well, MMA zones should help to sustain priority resources in the long-term while reducing or eliminating conflict between different users of the MMA, This will in turn improve the quality of activities such as tourism, fishing, cultural practices.

Regulations

Regulations specify the allowed or disallowed activities within a certain zone. They are essentially the rules for each of the zones and for the MMA overall. Common regulations for the marine environment include:

- Entry Restrictions: Limitations in entry by unauthorized individuals or vessels.

- Spatial Restrictions including No Take: Limiting take of marine species from certain areas
- Temporal Restrictions: Limiting take of marine species during certain times of the month or year.
- Gear Restrictions: Restricting the type of fishing gear that can be used in certain areas
- Species Restrictions: Limiting the type of species that may be taken from a certain area
- Take Limits: Limiting the number of a certain species that can be taken. Often called bag limits
- Size Restrictions: Limiting the size of species that can be taken. This can include minimum or maximum size limits as well as slot limits which mean you can only take individuals between a certain minimum and a certain maximum size.
- Use Restrictions: Limitations on the types of activities that can be conducted in certain areas. Common restrictions include creation of areas where you can carry out some types of marine recreation but not others, areas that only allow research, areas that are limited to traditional resources uses, etc.
- Collection Restrictions: Limitation on the take of other marine products including rocks, sand, shells, etc. from certain areas.

In many cases, one MMA may include several or all of these various types of regulations, applied to different zones.

As much as possible it is helpful to keep regulations and zoning schemes as simple and easy to understand while still helping to achieve the MMAs objectives.

Penalties

Penalties are the “sentence” or “punishments” that are levied on an individual who violates the regulations. These may include fines, prison terms, community service, seizure of fishing gear, or some other culturally appropriate punishment.

In most zonation systems a relatively set penalty is associated with violations of the regulations. Fishing in a no take area may punished by a fine of a certain monetary amount depending on how many fish were taken. In most cases, there is also some flexibility in the application of penalties based on the significance of the offense and the characteristics of the offender. For example, if an individual appears to have entered a no entry area by mistake and does not break any other regulations, a judge or council may decide not to penalize them in a significant way. If however, an individual appears to have purposely entered a no entry, no take area, and takes a large amount of a restricted species, the judge may decide that the violation is severe and penalize them at a high level. Also repeat offenders may be more severely penalized than first time offenders.

It is important to create a penalty system that is significant enough to discourage people from violating regulations. If for example, the penalty for poaching 500 hundred pounds of fish is only \$50 dollars but the fish is worth \$1000, poachers may find it worth the risk to violate the regulations. If however the penalty is a fine is \$1000 and includes seizure of the violators fishing gear, they may think twice about poaching again in the area.

Developing Zones, Regulations, and Penalties: The Process

For the purposes of this guide we refer to the process of developing Zones, Regulations, and Penalties as Zoning and the resulting Zones, Regulations, and Penalties as a Zoning Scheme.

The Steps for Zoning are linked directly with the steps for Management and Adaptation Planning. Most of the results from the planning process will feed directly into the process to create effective zones and regulations. However, the full Management and Adaptation planning process can be lengthy and is often only carried out after a project has been operating for one or more years. As a result, many projects establish their preliminary zones and regulations before they complete the full Management and Adaptation Planning process. However, for your zones to be as effective as possible, it is important to at least have completed several of the steps in Management and Adaptation Planning process as outlined below. Also, it is important to be flexible enough to adjust your zones, regulations, and penalties once you complete the full Management and Adaptation Planning process. Key processes from the Management and Adaptation Planning Guide that should be completed to support your zoning efforts include:

- Mapping your community and its key environmental and socio-economic features
- Identifying and prioritizing your natural and socio-economic resource targets
- Understanding threats including where they are occurring, their intensity, how they impact target resources and habitats.
- Understand the vulnerability of your target natural resources to climate change impacts
- Understand if there may be areas that may offer some resistance and resiliency to the impacts of climate change.
- Identify the desired results you are trying to achieve for your priority natural and socio-economic resource targets in terms of maintenance, recovery, and sustained use. If you have time you can develop full SMART objectives to reflect the desired results.
- Identified any other desired results in terms of processes, policy, threat reduction etc. Again if you have time develop SMART objectives.
- Understand your resources and habitats well enough to know which areas provide the greatest probability of supporting achievement of the objectives.
- Build enough trust with Stakeholder groups that they will speak openly and honestly about the uses of target resources and will be open to improved management.
- Understand important human uses well enough to know which areas and resources are high priorities for continued access and use. As well as which uses can be modified, and which areas can be managed or protected.

All of this information can be gathered through key steps in the Management and Adaptation Planning process. However, if you are not yet pursuing that process, we provide you guidance below on the steps from that process which are specifically important to developing your zoning and regulatory scheme.

Steps to Develop Zone, Regulations, and Penalties:

The following steps will be carried out through a participatory process that includes a significant amount of community and stakeholder consultation. However, some steps are best carried out by

the smaller planning team. Below we suggest which processes we feel are best to conduct with community and stakeholders and which are best conducted by the smaller planning team. However, each community should decide who that want to involve in each step.

Some of these steps are the same or similar to those in the Management and Adaptation Planning process. You can feel free to use the results from the Management Planning and Adaptation process to feed into the Zoning and Regulatory process and vice versa. We do not repeat worksheets that are already provided in the Management and Adaptation Planning Guide but simply refer to them as relevant and discuss ways in which each step helps to support the Zoning and Regulatory process.

1. Step One: Understand your Area, its Resources, and How Zoning May Benefit Your Community

Community and Stakeholder Meetings

- a. Overview: the Benefits of Zoning**
- b. Create a Map that will form the Foundation for the Other Steps**
- c. Identify and Map your Priority Natural and Socio-economic Resources**
- d. Identify All Habitats and Ecological Processes that are Important to Your Priority Resources**
- e. Map Resource Location and Characterize Resource Condition**
- f. Verify Resource Location and Condition Through Surveys**

2. Step Two: Understand Threats and Vulnerability

Community and Stakeholder Meetings

- a. Map and Characterize Important Human Uses and Threats to your Priority Resources**
- b. Consider Climate Change Vulnerability and Potential for Resilience**
- c. Finalize Resource Characterization**

3. Step Three: Understand your Desired Results

Planning Team Meetings

- a. Identify Solutions for the Threats to your Resources**
- b. Identify Desired Results for: Your Resources, Human Use, and Threat Reduction**

4. Step Four: Formulate the Optimal Resource Management Zones, Regulations, and Penalties

Planning Team Meetings followed by community and stakeholder review meetings

- a. Identify the Types of Activities that need to be Regulated to Achieve your Desired Results**
- b. Identify Regulations and Zones Needed to Achieve Your Desired Results**
- c. Develop Draft Penalty Scheme to Support Your Desired Results**
- d. Review Your Draft Zoning and Regulatory Scheme**
- e. Demarcate Zones through Field Clear Signage and Markers**

1. Step One: Understand your Area, its Resources, and How Zoning May Benefit Your Community

Step one is best carried out through one or more community and stakeholder meetings. These meetings will set the foundation for the zoning process and as a result it's important that as many community members as possible are involved. Decisions about stakeholders that will be invited should be made carefully. A complete Stakeholder analysis process is included in the Management and Adaptation Guide. The general rule of thumb is that the community is the primary decision maker, so in many cases communities chose not to involve outside stakeholder groups in their planning process but simply to consult with them to get their input in a more targeted manner either in one on one discussion or in small groups. In some cases, government will be a primary stakeholder and therefore may need to be involved regularly in planning process. However, most communities prefer to meet privately during some parts of the planning process to organize their thoughts before involving government and/or others.

As mentioned some of these steps, including Community Mapping, Identification of Priority Resources, and mapping the location and condition of priority resources, are also part of the Management and Adaptation Planning process and may have already been completed.

a. Overview: The Benefits of Zoning

The following information should be explained to community members and stakeholders, to help them understand the benefits of effective zoning and regulatory schemes.

The More You Give, the More You Get:

Most resource management programs strive to balance improvement or maintenance of natural resources and ecosystems with human use. In some cases improving populations of key species so that human's can catch and sell or eat them is the primary objective. In other cases protection of ecosystem health and/or biological diversity may be a primary objective. In some cases, communities may combine these objectives and therefore have to design a zoning scheme that can support achieving both and possibly other objectives.

It's now well understood that setting aside areas for marine species to grow and reproduce over a long-period of time can improve both the population and the catch of the species. Setting areas aside from exploitation also allow nature to take its course and provides for maintenance or improvement in ecosystem health and biodiversity conservation.

For every species there is a sustainable catch that can be maintained only if a certain breeding stock is maintained. For coral reef species that typically don't move over larger areas, one of the best ways to maintain a breeding stock is to simply close certain areas to take of that species. This provides a refuge in which these species can grow and breed.

Older fish produce more eggs and areas that have high reproductive output can provide spill over of larvae to seed other parts of the reef. Likewise, once populations grow inside refugia, adults may also spill over and be caught by fishers. The better the habitat is for the species in question,

the more likely the population will grow and result in larger levels of spill over of both larvae and adults.

While there are no guarantees that creating MMAs will result in these types of benefits, there is a growing body of evidence demonstrating that when large enough areas of good quality habitat are protected and there is sufficient breeding stock that they can produce significant benefits in terms of population increases and in many cases improvement in catch.

In many cases fisherman do not want to set aside important fishing grounds as a refugia for marine species. However, it is often these areas that have the greatest standing stock and may therefore have the greatest reproductive output. As a result, protecting these areas may often provide the best results in terms of improvements in populations and catch. The zoning process outlined in this document provides some suggestions as to how to go about assessing these types of areas and presents options for working with the fishing community to balance ongoing need for access to good fishing grounds with creation of refugia that will yield the best results possible.

The basic rule of thumb is: The More You Give, the More You Get. In other words, if you protect a large area of good habitat with a large breeding stock you are more likely to receive significant benefits. However, realizing these benefits takes time as populations of important species grow, breed, and increase in size and number.

b. Create a Map that will form the Foundation for the Other Steps

More complete guidance for mapping can be found in the Management and Adaptation Planning Guide in **Exercise Seven: MAPPING YOUR SITE AND SURROUNDING AREA.**

This first map will be a general map about the community area. It should cover the entire area where the community has some role or where they access resources. We suggest that you don't just focus on the a specific site such as an marine managed area on this initial map but that you include the entire community area, the location of houses and farms, the adjacent land and water area.

The map will form the foundation future exercises so it should include as much information as possible.

The maps will include the following:

- Community land and sea boundary
- Primary habitat types such as forest, mangrove, sea grass, coral reef, etc.
- Infrastructure such as roads, bridges, community facilities, evacuation routes, etc.
- Economic activities such as areas important for income generation such as fishing/ gathering spots, agriculture, local businesses, etc.
- Some information about the adjacent communities if it seems relevant.

The location of these elements can be approximated and drawn on either geo-referenced or perception maps to provide participants a much better understanding of the spatial relationship between resources and threats.

You should try to draw things with some sort of relative scale. If you have access to a geo-referenced map it's good to utilize it. For zoning, it will be helpful if precise locations can be identified using GPS and then put on a geo-referenced map using GIS software. If you have access to a GPS, you can be as accurate as possible in locating landmarks on your map. If however, resources are not available for this, landmarks and other mapping techniques can substitute for the high tech options.

c. Identify and Map your Priority Natural and Socio-economic Resources

An method and worksheet for identifying your priority resources is covered in the Management Planning and Adaptation Guide in **Exercise Thirteen: IDENTIFYING, PRIORITIZING, AND MAPPING NATURAL AND SOCIAL RESOURCE TARGETS.**

The purpose of this exercise is to identify and prioritize the natural and socio-economic resources within your area that should be addressed within your management and adaptation plan and that will be protected through your zoning scheme. Since these resources are the main target of our management initiatives, we will call them “natural and socio-economic resource targets.”

Natural resource targets can include the following:

- A priority ecosystem (a near-shore coral reef ecosystem, an atoll)
- A specific habitat type (sea grass beds, coral reefs, rivers and streams)
- A specific population of a species (migratory birds, grouper, parrot fish, sea cumpers)
- A charismatic and/or endangered species (hawksbill turtle, giant clams)
- A special geological feature (a blue hole)
- A special biological event (grouper spawning aggregation)
- Other

Socio-economic Resource Targets can include the following:

- Fresh water supply (catchments, aquifers, etc.)
- Agricultural fields or gardens
- Infrastructure (homes, churches, community buildings, roads)
- Emergency facilities (health centers, evacuation areas)
- Fishing grounds
- Areas for Tourism
- Other

Once you have completed the Resource Identification and Prioritization worksheet in Exercise Thirteen, you should be sure to have this completed worksheet available for the remainder of your zoning process.

d. Identify All Habitats and Ecological Processes that are Important to Your Priority Resources

Your priority resources may include species that are particularly important culturally, economically, or biologically. In addition you may also identify ecosystems or habitats that are important to your community. The key is to be sure that you understand how your target resources are linked ecologically to other features so that you can consider managing all relevant ecological features in your zoning system.

The following worksheet (with examples) will help you to identify ecological linkages that are important to supporting your priority resources. How important it is to protect or manage these linked features should be considered as you develop your zoning scheme.

Identifying Ecological Linkages

Priority Species	Linked Features (Critical ecosystems, habitats, locations, or species that support these resources)	Detailed Explanation of relationship (include key life history stages)	Degree of Importance
1. Grouper	Spawning aggregation sites	Grouper come together to spawn periodically in consistent locations. These aggregation sites need to be protected to protect grouper reproduction	Vital
2. Small Pelagic Fish	Mangroves and sea grass	Many small pelagic fish use mangroves and sea grass for nurseries areas	Vital
3. Sea Turtles	Beaches and sea grass	Marine turtles need well protected beaches for nesting and some species depend on sea grass for foraging	Vital

Priority Habitat	Linked Features (Critical ecosystems, habitats, locations, or species that support these resources)	Detailed Explanation of relationship (include key life history stages)	Degree of Importance
1. Coral Reef	Mangrove	Mangroves help to retain sediment	Importance

		to protect reefs and provide nursery areas for many coral reef fish	depends on site
	Herbivorous fish and other species such as sea urchins	Herbivores eat microalgae thus helping to prevent algae from taking over corals especially after bleaching. If algae do overtake dead coral after bleaching it reduces settlement of coral larvae thus severely limiting recovery of reefs	Vital
2. Mangrove	Upland forests	Healthy native upland forests reduce sediment run off and landslide thus reducing impact to mangroves, beaches, and coral reefs.	Importance depends on site

Priority Socio-economic resources	Linked Features (Critical ecosystems, habitats, locations, or species that support these resources)	Detailed Explanation of relationship (include key life history stages)	Degree of Importance
1. Subsistence fishing	Rabbit fish,	Rabbit fish are a key subsistence fish	Importance depends on site
	Sea grass	Rabbit fish and other subsistence and small scale economic species such as beche de mer depend on sea grass for parts of their life history.	Vital
2. Dive Tourism	Coral reef drop off areas and walls with healthy fish populations	Dive tourism often focuses on drop offs and walls where divers can see healthy coral and lots of fish	Importance depends on site

Once the vital linked features have been identified, they too can be considered priority resources to be managed since they are vital to the maintenance and health of your primary resources.

e. Map Resource Location and Characterize Resource Condition

Once you have identified your Priority Natural and Socio-economic Resources and vital linked features, it's important to map them. A community meeting can be an effective way

to map these resources. To the degree possible place these resources on your map in their relative location. Next you will conduct surveys with GPS to identify their location either on a geo-referenced map or relative to one another.

Based on community and stakeholder knowledge characterize the condition of your priority resources. The following worksheet will help you keep track of the condition of your various priority resources and linked features.

Initial Resource Characterization: Condition of your Priority Resources

Priority Resource or Linked Feature (Ecosystem, habitat, species, etc.)	Condition in majority extent (estimate percentage). Provide any research or survey results you may already have. Very Good, Good, Fair, Poor	Condition in remainder of extent (estimate percentage) Provide any research or survey results you may already have.
1. Coral Reefs	Live coral cover is 40% in over 80% of coral reef extent based on manta tow surveys Condition: Good	Live coral cover is less than 10 % in about 20 % of its extent due to anchor damage and bombing Condition: Poor
2. Grouper population	Priority species of Grouper are present over the majority of the coral reef area. Average size indicated most are young (few older adults present). Community interviews indicate the population has Condition: Fair	Same over majority of group habitat (coral reef area)
3. Grouper spawning aggregation	Interview with community members indicate numbers of grouper in spawning have reduced by approximately than 25% in the last 10 years. The average size of fish seems to have decreased Condition: Fair	There is only one spawning aggregation in the community area. Condition: Fair

Once the condition of your resources has been identified, devise a way to illustrate Very Good, Fair, and Poor and identify resource condition on your map.

f. Verify Resource Location and Condition through Surveys

This process will require field surveys to verify the location and quality of your community impressions. There are three main mapping options to improve the precision of your resource characterization depending on the amount of technology available.

1. Use a geo-referenced Map and GPS system.
2. Use a perception map and a GPS system
3. Use a perception map and a measuring system to improve precision.

In all cases a combination of manta tows, coastal walks, and snorkel and scuba-based surveys can be used. Given there are so many excellent guides to biological survey and monitoring available, we will not provide details on survey methodologies in this module. A biologist or experienced conservation practitioner can help with the design of your survey technique.

Depending on the size of your site, it may be helpful to divide the site into sections or units as possible with clearly defined permanent land-marks dividing the units.

1. Use a geo-referenced Map and GPS system.

The most accurate map will be one in which resources locations are identify using GPS and denoted on a geo-referenced map.

2. Use a perception map and a GPS system

Using a perception map it's important to identify a number of prominent land marks and record their GPS locations. Using these locations as a baseline reference point, it is possible to identify the relative location of resource features by taking GPS points and referencing them back to these original land mark sites.

3. Use a perception map and a measuring system to improve precision.

A perception map and measuring system uses basically the same approach as in Number Two. Chose one or more permanent landmarks and measure from this location. Manta tows of set lengths parallel to the coast can provide a good way to determine the extent of dominant habitat types.

2. Step Two: Understand Threats and Vulnerability

Step two is best carried out through one or more community and stakeholder meetings.

a. Map and Characterize Important Human Uses and Threats to your Priority Resources

Your base map should now be complete and include:

1. The full outline of your community
2. Infrastructure
3. The location of key habitats
4. The location and condition priority natural and socioeconomic resources (including location and condition of vital linked features including ecosystems, habitats, and species, which will now be considered priority resources as well.

You should have also completed the resource prioritization and resource characterization exercise. Be sure to have the results of these exercises available to refer to in the remainder of your zoning process.

Now it is time to identify and characterize human uses and threats to your priority resources. The following worksheets will help you to identify these elements that should then be mapped as well.

Human Uses

Priority Resources	Human Uses	Importance for Human Use	Location of Human Use
Coral Reefs	Subsistence and small scale fishing for coral reef fish	Very High – depend on coral reef fish for subsistence	Fishing grounds are mostly near the village and in one off shore islet
Marine Turtles	Cultural Consumption	Very High culturally Not a source of income	On turtle foraging grounds

Threats

Threat analysis including identification, impact and cause analysis, and prioritization is included in the Management and Adaptation Planning Guide. If you have conducted threat analysis already you may simply transfer the results from your planning process. If not, you can use the chart below to carry out a threat analysis. Please note the results should not be interpreted as a definitive ranking but provide a guide to which threats may be the most significant to your resources.

Priority Resource	Threats (current and future)	Cause of Threat	Impact		Area impacted by threat	Intensity (degree of the threats impact)	Urgency (How immediate is the threat)	Threat Priority Score
Coral Reefs	Sediment	Upland clearing and deforestation	Smother s and kills Reef		2	2	3	7
	Anchor Damage	Anchor-ing for tourism	Breaks and kills coral		1	2	2	5

Ranking system:

“Area” ranking:

- 1 = only a small amount of area at our site is affected by the threat
- 2 = a moderate amount of area is affected, but not all of the area at our site
- 3 = all of the area at our site is affected by the threat

“Intensity” ranking:

- 1 = low intensity; causes only minor impact or damage
- 2 = medium intensity; somewhat impacts/damages
- 3 = high intensity; high impact or highly destructive

“Urgency” ranking:

- 1 = not very urgent; does not require immediate activity
- 2 = somewhat urgent; will require activity soon
- 3 = very urgent; requires immediate activity

Once Human Uses and Threats have been analyzed, you should add them to your base map.

b. Consider Climate Change Vulnerability and Potential for Resilience

The Management and Adaptation Planning Guide provides detailed guidance for Vulnerability Assessment and Adaptation Planning. To the degree possible, vulnerability to the impacts of climate change should be assessed to support zoning. A full Vulnerability Assessment can take some time, so it’s good to prepare well in advance.

The important elements to consider include:

1. How exposed are your priority resources to climate change events?

2. How sensitive are your resources to the impacts of climate change? In most cases resources are more sensitive if they are already in a degraded state due to other threats
3. What is the capacity of your priority resources to resist impacts, to be resilient to impacts, or to adapt to the impacts?

Together these features provide an indication of how vulnerable your resources are.

Assessing your vulnerability requires you to consider:

1. What climate events have occurred in the past in your community?
2. How did they impact your priority resources?
3. How did your priority resources respond?
4. What is the condition of your priority resources?
5. Are there areas that are absolutely vital to the survival and your priority resources and if so what is their condition?
6. Are there any resources or areas that seem less affected by Climate Change related impacts or rebounded quickly.

As discussed in the Management and Adaptation Planning Manual, a full vulnerability assessment applies a combination of data collection techniques to gather this type of information. These include Historical Transects, Community Walks, Seasonal Calendars, Biological and Socio-economic Surveys, and others.

If you are able to undertake a vulnerability assessment using the guidance in the Management and Adaptation Guide, you can bring that information forward into your final resources characterization. If you do not have the resources to undertake a full vulnerability assessment prior to zoning you should at a minimum include key climate change vulnerability features in your resource characterization. These include:

1. Priority resources that seem particularly vulnerable to climate change impacts as a result of their exposure, their sensitivity, or their limited resistance, resilience, or adaptive capacity. These resources should be given special attention in developing zones and regulations to protect them from other non-climate change threats. Only by restoring and maintaining healthy ecosystems can natural resources have their greatest opportunity to overcome climate change impacts.
2. Areas that demonstrate particular resistance or resilience to impacts of climate change. This is that they either appear to be less affected by climate change impacts or they rebound quickly when impacted. These areas should also be given special attention as they may survive climate change impacts and provide founder stock for replenishing surrounding areas after the event.

c. Finalize Resource Characterization

Your final resource characterization will form a solid foundation from which to develop your zoning scheme. Fill out this form or use a narrative format for each priority resource. Be sure to include as much detail as possible and results from assessments and

previous analysis where possible. Any quantitative data that you have should be included. Once you have completed your full resource characterization, be sure to review your map to verify that you have mapped as many of the relevant aspects of your area and its resources as possible.

Priority Resource and other Vital Features	Condition (include majority of extent and other areas)	Human Uses and Importance	Highest Priority Threats (current and future) and results of analysis	Vulnerability to Climate Change Impacts	Areas of resistance or resilience
Coral Reefs	Live coral is good in about 60 % of extent Poor in about 40%. Healthier corals are farther from shore where there is less sediment	Tourism is moderately important now but has potential to grow. A new resort hotel is being built 5 miles away and may bring diving and snorkeling to the area	Sedimentation is covering about 40% of the reef area and is worse near the village. Areas with sediment are in poor condition. This threat is severe where it occurs and is urgent to address	Highly vulnerable to increase sediment loading from possible runoff in storms. Stronger water flow may result in larger sediment plumes and thus affect more reef area.	Reef walls recovered quickly from 1998 bleaching
				Highly vulnerable to bleaching. About 80% of reef area bleached in 1998	Shallow water reefs near village did not bleach in 1998 but have been impacted by sediment in the last 10 years
			Anchor Damage. Covers about		

			10 percent of the reef and is moderately severe. There is potential to grow with tourism. While not severe now, zoning and mooring buoys is easy and may prevent future threats		
Coral Reef Fish	Populations of herbivorous fish and predators seem to be about 50% of historical levels	Subsistence fishing of coral reef fish	Overfishing. Covers approximately 80% of the reef area and is intense in recent years. This threat is severe where it occurs and is urgent to address	Reproduction is vulnerable to increased sediment from runoff if storms become more intense	Areas that don't have sediment are better for reproduction

3. Step Three: Understand your Desired Results

Step Three is best carried out through community and stakeholder meetings for activity a. and planning team meetings for activity b.

a. Identify Solutions for the Threats to your Resources

The Management and Adaptation Planning Guide provides detailed guidance on how to go through the Threat/Solution model or conceptual modeling process. This process helps guide community members and stakeholders to identify threats and the causes of these threats as a first step to then developing solutions.

It is highly recommended to go through an entire Threat/Solution Model even if you are not completing a full Management and Adaption Plan at this time. This model can be carried out with community members and stakeholders and gives them a great opportunity to contribute to the overall planning process.

The following worksheet can help you to summarize the results of your Threat/Solution model or if you chose not to complete a model at this time you can use these worksheet to identify proposed solutions to priority threats.

Priority Resources	Priority Threat	Cause	Proposed Solution	Activities
Coral Reefs	Sedimentation	Upland clearing for farming and	Create buffer zones in riparian zones	<ul style="list-style-type: none">• Hold consultations with farmers to understand their needs and work with them to create buffers• Pass local regulation to create buffer zones
		Invasive species less effective at holding soil	Reduce populations of invasive species especially on steep slopes and in riparian zones	<ul style="list-style-type: none">• Organize community invasive species control near rivers and on slopes• Replant natives in riparian zones and on steep slopes
		Mangroves have	Mangrove	<ul style="list-style-type: none">• Hold

		been cleared so don't hold sediment	replanting and no cutting zones	community meetings to organize replanting effort <ul style="list-style-type: none"> • Include identification of no planting zones in zoning work
			Settlement ponds in flat land areas near shore	<ul style="list-style-type: none"> • Seek engineering advice on how to build settlement ponds and assess feasibility

b. Identify Desired Results for: Your Resources, Human Use, and Threat Reduction

Your Zoning Scheme should be designed to support the objectives you want to achieve for your natural resources, for human use, and for threat reduction. Objectives are typically a measureable statement of the Results that you want to achieve. The Management and Adaptation Planning Guide provides a detailed process for articulating SMART Objectives that will help you to achieve your desired results and overcome your main threats and their causes.

If you are developing SMART Objectives, you can use these Objectives to guide you in your zoning process. However, if you are not yet at the stage of developing SMART objectives, you can identify your desired results for each of your resources in terms of Resource Condition, Human Use, and Threat and Vulnerability Reduction. These desired results will help guide the decisions you need to make about how to zone and regulate your area. After identifying your desired results, be sure to check if any of these results are mutually exclusive. For example, in one community MPA, the community wanted to complete restore their atoll to a “pristine” ecosystem while also supporting subsistence levels of fishing. After discussion, they recognized that it is not possible to have both a pristine ecosystem over the entire atoll if subsistence fishing is also allowed in some areas. As a result, they decided instead to zone their atoll to allow no fishing in 70% of the reef and allow subsistence fishing in 30% of the reef. This then allowed them to have 70% of their reef returning to a pristine natural system and 30% of the reef supporting subsistence fishing which was very important to the local community.

Desired Results

Resource	Resource Condition	Human Use	Threat and Vulnerability Reduction
Coral Reef	Maintain healthy coral reefs away from shore and restore coral reefs and good water quality near shore	Coral reefs are sufficient healthy to allow for good fishing and sustainable tourism.	<ul style="list-style-type: none"> • Eliminate anchor damage. • Restore populations of herbivorous fish to help reduce long-term impacts from bleaching • Protect most resilient reef areas • Reduce sediment to as low as possible • Reduce cumulative impacts in at least 50% of reef.
Coral Reef Fish	Restore populations of top predators and herbivores over as much of the reef area as possible	Ensure fishermen are able to sustain current livelihood levels from fishing until alternatives can be developed	<ul style="list-style-type: none"> • Eliminate all illegal fishing • Reduce over-fishing in at least 50% of reef area. • Fully protect at least 30% of the high productive reef area

4. Step Four: Formulate the Optimal Resource Management Zones, Regulations, and Penalties

Step Four is best carried out through planning team meetings and then through community and stakeholder meetings to review the results

The essence of a good zoning and regulatory scheme is that it reduces your threats and vulnerability to support your efforts to achieve your objectives or your desired results. Most resource management efforts are balancing acts between immediate needs and future benefits. Natural resources and ecosystems can only provide a limited amount of benefit for local communities and stakeholders. In order to support most objectives, the zoning and regulatory scheme must strike the optimal balance between protection and use. In many cases, stakeholders must either be willing to sacrifice access to certain areas or resources or work hard to help make sure their activities do not impact resources and result in an unbalanced system. A few key questions which are covered in this Step will help you find the balance.

Before we move on, let's review what we have done so far. The previous activities undertaken in this module have provided the background knowledge necessary to develop your zoning system. At this point you have:

- Explained the benefits of zoning and regulations to your community and stakeholders
- Create a base map that illustrates the key features of your community.
- Identified your priority natural and socio-economic resources
- Characterized the condition of your resources
- Verified resource location and condition through surveys
- Mapped your resources and their condition
- Identified and mapped threats to your resources
- Characterized and prioritized your threats including their impact and their causes
- Identified the vulnerability of your resources to impact from climate change
- Identified areas that may be particularly resistant or resilient to climate change impacts.
- Completed your Resource Characterization.
- Identified the results or objectives that you want to achieve in terms of resources, human use, and threat reduction.

Applying all this background knowledge you can now develop your zoning system.

It is important at this stage to have a very clear, well populated map that shows at a minimum:

1. Community boundaries, habitats, and infrastructure
2. Priority natural and socio-economic resources and their condition
3. Ongoing human uses including areas that are essential culturally or economically.

4. Threats
5. Areas that are particularly vulnerable to climate change impacts
6. Areas that seem resistant or resilient to climate change impacts

You will use this map as the base for development of your zones.

a. Identify the Types of Activities that need to be Regulated to Achieve your Desired Results

First you should identify all the types of activities that you believe must be regulated in order to achieve your desired results. At this stage, just list the activities. We will develop zones and regulations for these activities soon.

Brainstorm with your planning team or a small community group identifying the activities you need to regulate. After you have your full list of activities, check your Desired Results to verify that you have covered everything you can think of. When you actually develop zones and regulations for these activities we will check again to see if the zones and regulations will be enough to help you achieve your desired results.

Examples of things that your community may want to regulation include:

1. Fishing levels and locations
2. Fishing of certain species in certain areas
3. Size of take allowed
4. Take of adults of key species
5. Use of Gill Nets
6. Use of explosives
7. Use of chemicals for fishing
8. Breaking of coral while fishing
9. Fishing on spawning aggregations
10. Taking of turtle eggs and nesting turtles
11. Cutting of native vegetation near riparian zones
12. Cutting of mangroves
13. Protection for areas that demonstrate particular resistance or resilience to climate change impacts.

b. Identify Regulations and Zones Needed to Achieve Your Desired Results

List the regulation and corresponding zones on the table below. These should support achieving your desired results. It is important to recognize that the simpler your zoning scheme the easier it will be for people to understand it and comply with it. If possible keep your zoning scheme simple enough to explain in a few bullet points.

Regulation	Zone (Describe, draw on the map, and provide GPS points.)	Result it Helping to Achieve	Reasons this Zone will help you to achieve this Result
Fishing or Marine Life Collection			
1. No fishing with Gill Nets	1. Entire managed area	1. Eliminate destructive fishing and overfishing	1. Gil nets are extremely destructive and therefore not appropriate for the entire managed area
1. No fishing or collection of marine life at all	1. North 30% South 20% of the managed area parallel to shore. These are Zones A and B respectively (Provide GPS points.)	1. Restore populations of top predators and herbivores over as much of the reef area as possible 1. Restore populations of herbivorous fish to help reduce long-term impacts from bleaching 2. Eliminate all illegal fishing 3. Reduce over-fishing in at least 50% of reef area. 4. Fully protect at least 30% of the high productive reef area	1. These areas provides very good habitat for six target species but does not take up all fishing ground for these species 2. A survey indicated this area is the best area to manage to increase fisheries
1. Subsistence Fishing	1. Middle 50% of the managed area (zone C) is open to subsistence fishing following the associated regulations: • No non-community members may fish	1. Ensure fishermen are able to sustain current livelihood levels from fishing until alternatives can be developed	1. This area has safe shoreline access 2. This area is where community members typically fish and includes good fishing

	in this area without permission of the Community council. <ul style="list-style-type: none"> • No take of grouper • No sale of reef fish • Sale of pelagic fish is allowed • No take of turtles (except for community sponsored events (take will be organized by the community council)) 		grounds 3. This area is large enough to provide for subsistence fishing by the community

While we have only populated this Regulation and Zoning Scheme with a few examples, we illustrate below how the scheme can be summarized easily so people can understand it and comply with it.

1. The Entire Managed Area: No fishing with Gil Nets, no take of grouper, no take of reef fish for sale, and no take of turtles (except as directed by the Community Council)
2. Zone A and B: No fishing or collection of marine life at all (totaling 50% of the managed area)
3. Zone C: Subsistence fishing encouraged (but comply with regulations for the entire managed area above).

These zones can be easily drawn on a map using local land marks with their regulations shown.

c. **Develop Draft Penalty Scheme to Support Your Desired Results**

Violations of regulations should have a penalty that is sufficient to discourage future violation. Penalties may include fines, jail time, public service, seizure of fishing equipment, and others.

Your penalty scheme should be enshrined by a local law or statute that is enforceable.

Ideally, your community and neighboring communities will agree with the regulations and therefore comply. The process of involving community members and stakeholders from the beginning should help with this. Also, once your system is finalized you will need to conduct awareness on your regulations, zones, and penalties so that people will be well aware and can comply.

However, it is very likely that accidental and purposeful violations will still occur. As a result, it is essential that you have a good observation, compliance, and enforcement system in place so that violators will be detected and apprehended.

Some communities may chose to levee the same penalty for all violations. Others may choose to change the penalty depending on the regulation that is violated. It is also very common to increase the severity of the penalty based on the number of offenses or based on the severity of the violation. For example, poaching a few fish may receive a lighter sentence then poaching hundreds.

Some communities may chose to levy the penalty on a case by case basis. While this may appeal to some communities it should be considered carefully as it has potential to result in violators claiming they have been treated unfairly compared to others. A consistent penalty scheme may cause less confusion and result in fewer complaints.

Penalty Scheme: (Note: individuals unable to pay fines will be responsible for 1 hour of supervised community service for every 10 fine dollars)

Regulation	Severity	Penalty		
		First Offense	Second Offense	Third or More Offenses
Fishing in No Take Zone	Low (10 or fewer fish)	Fine of 20 USD	Fine of 100 USD	Fine of 200 USD and seizure of fishing gear
	Moderate (10 to 20 fish)	Fine of 40 USD	Fine of 150 USD	Fine of 300 USD and seizure of fishing gear
	Severe (more than 20)	Fine of 80 USD	Fine of 200 USD	Fine of 500 USD and seizure of fishing gear

d. Review Your Draft Zoning and Regulatory Scheme

Once you have developed your draft zoning and regulatory scheme, it's important to review it both to ensure your Scheme will be sufficient to achieve your desired results and to verify that community members and stakeholders are satisfied with the plan. Not all community members and stakeholders will necessarily agree with it, but at a minimum a majority of community members should agree with and be satisfied with the scheme.

To verify that your scheme will support you to achieve your desired results, you need to look at each result and the ways in which the zoning and regulatory scheme will support the result. This will also help you to justify the scheme with the local community and stakeholders.

If as you review your results you find that you do not have a regulatory or zoning mechanism to help support all of them you should consider if other management actions will support the missing results or if you need to come up with some regulatory and zoning approach.

Desired Results	Regulatory and Zoning Scheme	How the scheme will support the desired results	Changes Needed ?
Restore populations of top predators and herbivores over as much of the reef area as possible	No fishing or collection of marine life at all in the northern 30% and southern 20% of the managed area	These two areas have excellent fish habitat, include the areas only spawning aggregation. Scientists recommend at least 30% no take	No changes needed
Eliminate destructive fishing and overfishing	No fishing with Gill Nets over the entire managed area	Gill nets are the most destructive fishing method in use. Fishing with chemicals and explosives is already illegal nationally	No changes needed at this time
	No fishing or collection of marine life at all in the northern 30% and southern 20% of the managed area	This will eliminate all destructive fishing by eliminating all fishing in 50% of the reef. This is more than the typically recommended 30% no take	No changes needed
	<p>Middle 50% of the managed area (zone C) is open to subsistence fishing</p> <ul style="list-style-type: none"> • No non-community members may fish in this area without permission of the Community council. • No take of grouper • No sale of reef fish • Sale of pelagic fish is allowed 	Destructive fishing will be eliminated through these regulations. However, there are some possibilities that subsistence fishing could reach unsustainable levels.	May need to look into further regulations to manage subsistence fishing depending on level of take

	<ul style="list-style-type: none"> • No take of turtles (except for community sponsored events (take will be organized by the community council)) 		

If available a trained biologist should have been working with your community throughout the process. At this stage either that biologist or community members who are knowledgeable about the ecology and fisheries of the area, should be asked to review the draft zoning and regulatory scheme.

To ensure that your zoning system will be supported you should review the scheme with community members and stakeholders and refine as needed. While not all community members and primary stakeholders will necessarily agree with the scheme, it's important that there is not a major disagreement over any particular elements of the scheme. This could result in community members ignoring the scheme and violating its regulations.

It's important to consider that it can take several consultations and meetings to overcome any potential opposition to your draft zoning and regulatory scheme. Hopefully your earlier consultative process will have resulted in a scheme that is generally accepted by the community and primary stakeholders. However, it is possible that some opposition may arise. Rather than pushing through with a scheme that is not well supported, it's important to go through necessary consultations to generate sufficient support or adapt the scheme as needed. You should be sure to have solid justification for the scheme on biological and socio-economic grounds and be ready to demonstrate how this scheme is designed to improve the situation in the community. For example, if the scheme covers 30% of good fishing ground with a no take zone, you need to clearly articulate to community member that 70% of the fishing ground is still available and by protecting this 30% that it will help to increase the population of fish that are important for their subsistence. You should not promise this as you cannot control the reproduction of the fish. However, protecting 30% in an area of good habitat with a reasonable founder stock should help improve the population.

If you need to adjust the scheme for it to be accepted, this is better than pushing through a scheme with no support. The key is to make sure that opposition does not end up diluting the scheme such that it will not achieve the desired results. It is critically important to take the time for community members to understand the essential elements of the scheme that are key to achieving desired results. This may require additional awareness raising and may take considerable time before your scheme is accepted.

Once the scheme is accepted it's important to officially launch the new scheme and organize additional awareness raising about you new Regulations, Zones, and Penalties.

e. Demarcate Zones through Field Clear Signage and Markers

Now that your zoning scheme has been accepted, it's vital that you clearly mark the zones and provide good signage explaining the zones, regulations, and penalties. Some managed areas use buoys or floating signs; however these can be valuable and are subject to theft. Several communities chose to use traditional methods such as placement of palm fronds or floating bamboo markers as these are less valuable and therefore less often stolen. Whatever your chosen approach, a clear system to establish and maintain markers is critical to success.

Good luck with your new zoning and regulatory scheme. We sincerely hope this scheme will help your community achieve its desired results and sustain the vital resources that are so important to the community's quality of life and future.